HIGH-POWER LASER-PLASMA INTERACTION IN NANOSECOND REGIMES "AT A GLIMPSE" USING PROTON DEFLECTOMETRY

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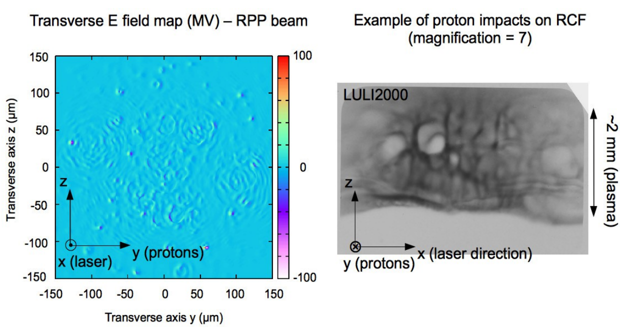
Detailed knowledge and understanding of the laser-plasma interaction in general is of fundamental interest for the success of inertial confinement fusion (ICF), both in the indirect drive approach of ICF, where high-power laser beams have to propagate through several millimeter of plasma before reaching the hohlraum walls, and in the direct drive approach, where the reduction of the imprint on the fuel capsule could be achieved through plasma induced smoothing [1]. Regarding the propagation of intense laser beams in low-density plasmas, recent experiments on the LIL and NIF (NEL) facilities [2-4] brought to the light the difficulty to model such laser plasma propagation.



Setting aside ionization that involves atomic physics, laser propagation in plasmas depends mainly on the local electron temperatures and densities that can trigger instabilities such as self-focusing and stimulated scattering off plasma waves. We propose to investigate this interplay by probing the electric fields driven by electron transport and ponderomotive effects (i.e. electron pressure gradients) inside the plasma through proton deflectometry [5], see the figure above. In addition to the usual optical measurement, this diagnostic provides unique characterization of the laser-plasma interaction. In a joint effort, we explore this new tool both experimentally at the LULI 2000 facility and numerically, by using the Monte-Carlo transport code DIANE [6] in order to compute the proton deflectometry due to the local electric fields calculated by our 3D paraxial code Hera [7].

[1] J. Fuchs *et al.*, Phys. Rev. Lett. 86, 432 (2001).
[2] P. Loiseau *et al.*, Accepted in IOP Conf. Series (2015).
[3] C. Rousseaux *et al.*, Phys. Plasmas 22, 022706 (2015).
[4] S. Glenzer *et al.*, Nat. Phys. 3, 716 (2007).
[5] L. Lancia *et al.*, Physics of Plasmas 18, 030705 (2011).
[6] D. Riz *et al.* , Nucl. Fusion 46, 864 (2006).
[7] P. Loiseau *et al.* , Phys. Rev. Lett. 97, 205001 (2006).